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National Priority Chemicals Trends Report (2000-2004)

Section 4
Chemical Specific Trends Analyses for Priority Chemicals (2000−2004): Lead and Lead Compounds (Lead)

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Lead and Lead Compounds (Lead)

Chemical Information:

Lead is a heavy, silver−white metal in its pure (elemental) form. When exposed to air, it reacts with it and turns bluish−gray. Its physical properties include a relatively low melting point (327 degrees C), high density, and an ability to shield radiation, sound waves, and mechanical vibrations. Lead exists in either one of two forms: as the pure metal (i.e., lead metal) or as a compound, in which the lead is combined with some other element or elements. Examples of lead compounds include: lead oxide, lead sulfide, and lead acetate. Lead metal and lead compounds are widely used in a variety of products and applications including lead−acid batteries, ammunition, construction materials, solder, metal castings, glass and ceramic products, plastics, electrical cable coverings, lubricating oils and greases, and certain paints.

CAS Number − 7439−92−1

General Uses − Lead is often obtained by primary production through mining of ores or by secondary production through recycling. Lead and lead compounds are used in the manufacture of a variety of products. The most prominent uses of lead are in storage batteries, pigments, ceramic products, ammunition, sheet lead, casting metal, and solder. Various other industries use or make metal products that contains lead. These metal products include sheet lead, casting metals, solder, bearing metals, extruded products, and brass and bronze alloys (EPA 2000/2001 TRI Public Data Release Report).

Potential Hazards − Lead can affect almost every organ and system in the body. The most sensitive is the central nervous system. At high levels, lead can decrease reaction time, cause weakness in fingers, wrists, ankles, and possibly affect the memory. Health effects associated with exposure to inorganic lead includes, but are not limited to, neurotoxicity, developmental delays, hypertension, impaired hearing acuity, impaired hemoglobin synthesis, and male reproductive impairment. Importantly, many of lead's health effects may occur without overt signs of toxicity. Lead has particularly significant effects in children, well before the usual term of chronic exposure can take place (http://www.epa.gov/iris/subst/0277.htm).

Summary Analysis:

- NATIONAL: In 2004, approximately 4,600 facilities reported 32 million pounds of lead. Compared to the quantity reported in 2000, there was a decrease of approximately 5.5 million pounds or 15 percent in 2004.
- REGIONAL: In 2004, facilities in Regions 3, 4, 5, and 7 reported approximately 72 percent of the total quantity; Regions 4 and 5 facilities alone reported approximately 50 percent of the total quantity.
- STATES: Facilities in every state and territory reported lead in 2004; facilities in 16 states reported approximately 80 percent of the total quantity. Indiana facilities reported the largest quantity (4.7 million pounds), accounting for approximately 15 percent of the total quantity.
- FACILITIES: Of the 4,580 facilities that reported lead in 2004, five facilities accounted for approximately 24 percent of the total quantity of this chemical. Fifty-three facilities accounted for approximately 69 percent of the total quantity.
- MANAGEMENT: Almost 100 percent of lead was land disposed.
- INDUSTRY SECTOR: Facilities in more than 300 industry sectors reported lead in 2004; facilities in 17 industry sectors accounted for approximately 90 percent of the total quantity. Facilities in SIC 3341 (Secondary nonferrous metals) and SIC 3312 (Blast furnaces and steel mills) reported approximately 60 percent of the total quantity.

National Trends:

Exhibit 4.131 shows the number of facilities that reported lead in 2000 to 2004 and the quantities that were managed via disposal, treatment, energy recovery, and recycling. Since 2000, lead constituted, by far, the largest quantity of any of the PCs. In 2004, approximately 4,600 facilities reported 32 million pounds of lead and lead compounds.

Some additional observations concerning increases and decreases include:

- Compared to the quantity reported in 2000, there was a decrease of approximately 5.5 million pounds (or 15 percent) in 2004. The quantity also decreased significantly, by 3.1 million pounds (or approximately 9 percent) compared to the quantity reported in 2003.
- Exhibit 4.131 shows that the number of facilities that reported lead since 2001 has been relatively constant. In 2001, there was a significant increase in the number of facilities reporting lead. Most of this increase likely can be attributed to the lowered TRI reporting threshold for lead that became effective for the 2001 TRI reporting year. Although the number of reporting facilities more than quadrupled, the reported PC quantity of lead actually decreased by approximately 1.3 million pounds. As such, quantities of lead newly reported by the facilities due to the lowered TRI reporting threshold were more than offset by decreased quantities reported by the other reporting facilities.
- Almost 100 percent of lead was land disposed. This is indicative of the fact that metals, including lead, are not amenable to destruction via treatment and have no energy value.
- Although treatment and energy recovery quantities were reported for lead since 2000, these quantities have decreased significantly – likely due to improved data quality assurance by the TRI program and increased awareness by reporters that land disposal is the most suitable method to be reported for this chemical.
- In 2004, approximately 707 million pounds of lead were recycled; this was an increase of approximately 92 million pounds or 15 percent compared to the quantity reported in 2003 and was the largest quantity recycled since 2000.

Exhibit 4.131. National Management Methods for Lead and Lead Compounds, 2000−2004

Management Methods for Lead and Number of Facilities	2000	2001	2002	2003	2004	Percent Change (2000−2004)	Management Method − Percent of Quantity of This PC (2004)
Number of Facilities	1,073	4,808	4,727	4,656	4,580	328.1%	-
Disposal Quantity (pounds)	31,806,580	33,742,749	34,010,413	35,042,589	31,891,332	0.3%	99.8%
Energy Recovery Quantity (pounds)	11,010	110,629	5,984	265	647	−94.1%	0.0%
Treatment Quantity (pounds)	5,610,482	2,286,114	82,045	27,066	75,631	−98.7%	0.2%
Priority Chemical Quantity (pounds)	37,428,072	36,139,492	34,098,442	35,069,921	31,967,610	−14.6%	-
Recycling Quantity (pounds)*	770,164,125	643,916,565	653,983,019	615,627,694	707,210,558	−8.2%	-

*Note: Waste minimization is the emphasis of this Report. As such, we primarily focus on quantities of PCs that are managed via onsite/offsite disposal, treatment, or energy recovery because we believe these PC quantities offer the greatest opportunities for waste minimization. Because recycled quantities of PCs are already directed to their best uses, they are considered separate and distinct from the quantities of PCs not recycled. Throughout this section, the recycled quantity is presented to provide some perspective regarding the quantity of this PC already recycled compared to the quantities that are managed via disposal, treatment, and energy recovery and thus potentially available for waste minimization.

Exhibit 4.132 shows the number of facilities that reported lead, within ranges of quantities. Of the 4,580 facilities that reported lead in 2004, five facilities accounted for approximately 24 percent of the total quantity of this PC. Fifty−three facilities accounted for approximately 69 percent of the total quantity. Approximately 2,650 facilities accounted for less than 0.1 percent of the total quantity of lead in 2004.

Exhibit 4.132. Distribution of Quantities by Facilities Reporting Lead and Lead Compounds, 2004

Lead (31,967,610 pounds)		
Quantity Reported	**Number of Facilities Reporting This Quantity (2004)**	**Percent of Total Quantity of This PC (2004)**
up to 10 pounds	1,586	less than 0.1%
11 − 100 pounds	1,063	0.1%
101 − 1,000 pounds	1,085	1.3%
1,001 − 10,000 pounds	578	6.1%
10,001 − 100,000 pounds	215	23.4%
100,001 − 1 million pounds	48	45.3%
> 1 million pounds	5	23.8%

EPA Regional Trends:

Exhibits 4.133 and 4.134 show the quantity of lead reported by facilities in each EPA Region from 2000 to 2004. In 2004, facilities in Regions 3, 4, 5, and 7 reported approximately 72 percent of the total quantity; Regions 4 and 5 facilities alone reported approximately 50 percent of the total quantity. Some additional observations concerning increases and decreases include:

- Compared to quantities reported in 2000, facilities in Regions 4, 5, 8, and 10 reported larger quantities in 2004. The largest increase of approximately 1.3 million pounds was reported by Region 4 facilities.
- In the six Regions where quantities decreased compared to 2000, facilities in Regions 3, 6, and 7 reported decreases of at least 1 million pounds and facilities in Region 2 reported a decrease of approximately 2.4 million pounds.
- Compared to 2003 quantities, facilities in Region 7 reported a decrease of approximately 3.3 million pounds and facilities in Region 4 reported a decrease of approximately 730,000 pounds.

Exhibit 4.133. Regional Quantities of Lead and Lead Compounds, 2000−2004

EPA Region	2000 (pounds)	2001 (pounds)	2002 (pounds)	2003 (pounds)	2004 (pounds)	Percent Change in Quantity (2000−2004)	Percent of Total Quantity of This PC (2004)
1	346,011	628,798	298,680	343,463	281,452	−18.7%	0.9%
2	3,094,854	1,819,202	1,098,416	987,567	743,143	−76.0%	2.3%
3	4,880,998	4,233,606	2,674,503	3,058,526	3,274,457	−32.9%	10.2%
4	5,447,811	6,258,609	7,405,178	7,495,502	6,768,339	24.2%	21.2%
5	8,611,927	7,963,541	9,157,704	8,939,834	9,032,565	4.9%	28.3%
6	4,063,854	4,472,529	3,027,283	2,658,849	3,022,428	−25.6%	9.5%
7	5,889,663	5,743,321	6,212,781	7,321,440	4,062,679	−31.0%	12.7%
8	1,357,272	1,209,972	1,049,706	1,403,956	1,516,155	11.7%	4.7%
9	2,629,916	2,534,579	2,332,850	2,044,597	2,073,876	−21.1%	6.5%
10	1,105,766	1,275,336	841,342	816,187	1,192,517	7.8%	3.7%
Total	**37,428,072**	**36,139,492**	**34,098,442**	**35,069,921**	**31,967,610**	**−14.6%**	**100.0%**

Exhibit 4.134. Distribution of Facilities Reporting Lead and Lead Compounds in 2004 and the Quantities of Lead and Lead Compounds Reported in 2004 per Region

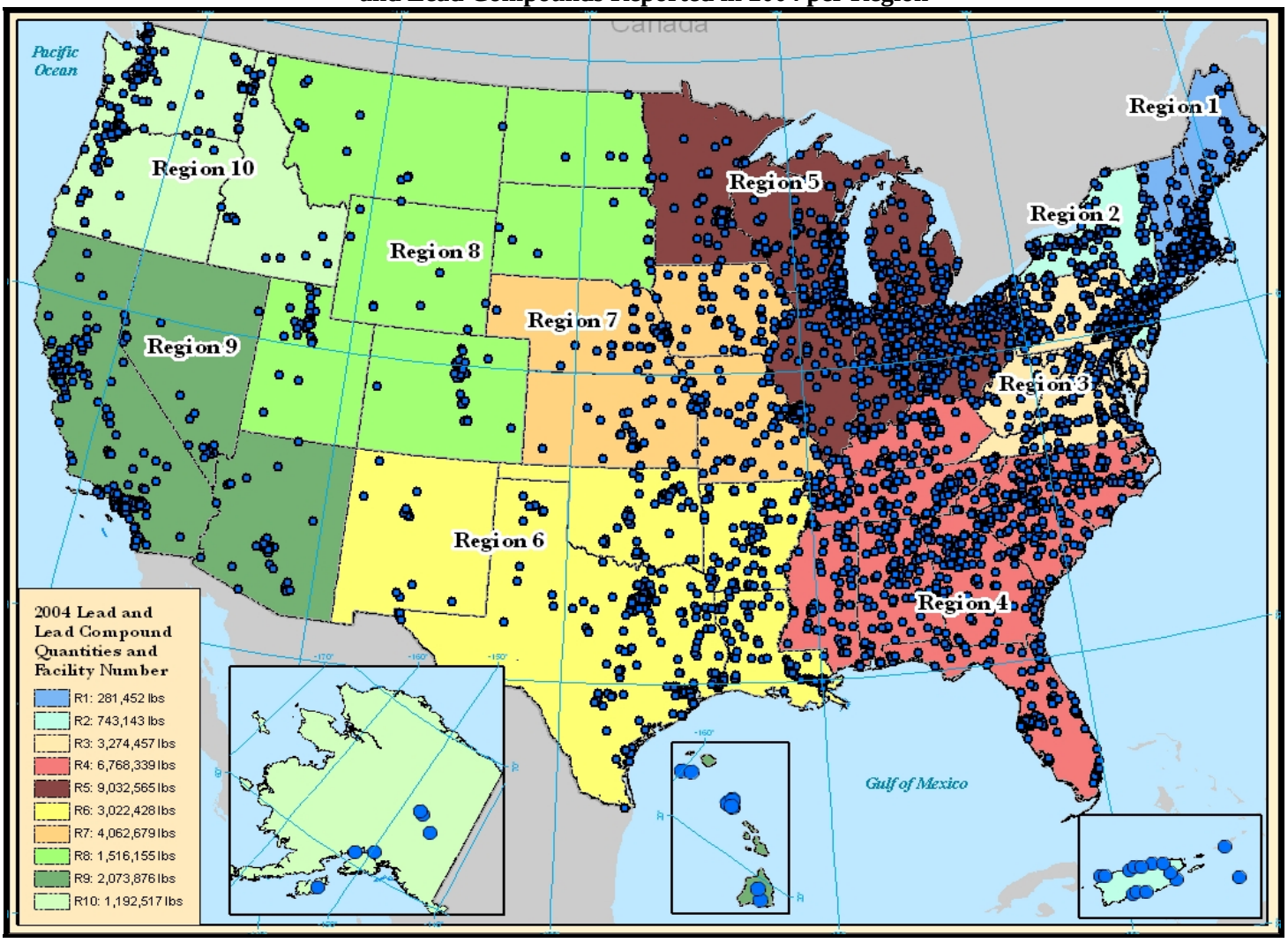


Exhibit 4.135 shows how facilities managed lead, by EPA region, in 2004. Virtually all lead was land disposed; facilities used offsite disposal for approximately 79 percent of this chemical. Facilities in every EPA region reported significant recycling of lead; in every EPA region, the recycled quantity far exceeded the quantity that was land disposed. Facilities in Regions 4, 5, and 7 reported approximately 80 percent of the recycled lead; Region 5 facilities alone reported approximately 45 percent of the total quantity.

Exhibit 4.135. Regional Management Methods for Lead and Lead Compounds, 2004

EPA Region	Quantity of Lead (2004)	Percent of Total Quantity of Lead (2004)	Disposal (pounds)		Energy Recovery (pounds)		Treatment (pounds)		Recycling (pounds)	
			Onsite Disposal	Offsite Disposal	Onsite Energy Recovery	Offsite Energy Recovery	Onsite Treatment	Offsite Treatment	Onsite Recycling	Offsite Recycling
1	281,452	0.9%	14,360	266,856	0	0	0	236	39,707	1,654,239
2	743,143	2.3%	227,726	504,065	0	0	333	11,019	4,481,278	22,512,926
3	3,274,457	10.2%	137,739	3,136,407	0	311	0	0	20,357,187	12,542,680
4	6,768,339	21.2%	3,426,153	3,290,635	7	320	1	51,223	46,016,546	92,173,278
5	9,032,565	28.3%	380,091	8,650,313	0	0	3	2,158	252,630,702	62,203,573
6	3,022,428	9.5%	1,290,797	1,731,596	0	0	0	34	26,431,327	16,087,756
7	4,062,679	12.7%	189,366	3,863,302	0	10	0	10,000	62,305,779	48,701,991
8	1,516,155	4.7%	220,583	1,295,533	0	0	0	39	87,137	5,857,994
9	2,073,876	6.5%	382,317	1,690,975	0	0	503	81	15,899,502	10,798,230
10	1,192,517	3.7%	264,173	928,344	0	0	0	0	2,775,543	3,653,184
Total	**31,967,610**	**100.0%**	**6,533,305**	**25,358,027**	**7**	**641**	**840**	**74,790**	**431,024,707**	**276,185,851**

State Trends:

Facilities in every state and territory reported lead in 2004. Exhibit 4.136 shows the quantity of lead, in 2000−2004, in the 16 states where facilities reported approximately 80 percent of the total quantity in 2004. Facilities in Indiana reported the largest quantity (4.7 million pounds) of lead in 2004, accounting for approximately 15 percent of the total quantity. Exhibits 4.137, 4.138, and 4.139 show the trends for the quantities of lead in the top five states in which facilities reported this PC in 2004.

Some additional observations concerning increases and decreases include:

- Compared to quantities reported in 2000, facilities in eight of these 16 states reported a larger quantity of lead in 2004; facilities in Indiana, Alabama, and North Carolina reported an increase of approximately 4.8 million pounds.
- Compared to quantities reported in 2003, facilities in 10 of the 16 states reported an increase; Indiana facilities reported approximately 42 percent of the 2.4 million pound increase in 2004.
- Compared to quantities reported in 2000, facilities in each of the eight states for which the quantity decreased by 2004 reported a decreases of at least 700,000 pounds, with decreases of at least 1 million pounds in four of the states.
- Compared to quantities reported in 2003, facilities in six of the 16 states reported a decrease in 2004; Missouri facilities reported a decrease of approximately 3.3 million pounds, or 67 percent. Most of the decreased quantity in Missouri was reported by one facility.

Exhibit 4.136. State Quantity Trends for Lead and Lead Compounds, Facilities Reporting 80 Percent of the Total Quantity, 2004

State	Total Quantity (pounds) of Lead					Change in Quantity (2000−2004)	Percent Change in Quantity (2000−2004)	Percent of Total Quantity of This PC (2004)
	2000	2001	2002	2003	2004			
IN	2,578,527	2,544,316	3,682,342	3,731,079	4,734,448	2,155,921	83.6%	14.8%
AL	1,737,728	2,217,376	3,494,741	3,272,310	3,599,465	1,861,737	107.1%	11.3%
PA	4,408,396	3,419,886	2,043,884	2,431,687	2,531,839	−1,876,557	−42.6%	7.9%
OH	3,311,640	2,766,651	3,120,068	2,596,496	1,982,321	−1,329,319	−40.1%	6.2%
CA	2,614,864	2,294,597	1,957,584	1,640,892	1,776,292	−838,573	−32.1%	5.6%
MO	2,467,289	3,634,772	3,910,471	4,868,664	1,601,701	−865,588	−35.1%	5.0%
TX	1,180,029	2,102,547	1,592,121	1,308,808	1,381,123	201,094	17.0%	4.3%
NE	2,411,580	1,240,341	1,283,688	1,403,425	1,349,842	−1,061,738	−44.0%	4.2%
UT	979,331	881,372	926,109	1,181,262	1,088,558	109,227	11.2%	3.4%
NC	161,130	841,669	880,711	954,008	1,017,120	855,990	531.2%	3.2%
IL	1,777,737	1,197,219	1,014,496	1,097,130	978,242	−799,495	−45.0%	3.1%
IA	969,010	787,513	919,955	944,455	972,383	3,373	0.3%	3.0%
AR	2,524,498	1,846,360	724,049	604,492	707,108	−1,817,390	−72.0%	2.2%
VA	448,922	738,852	570,281	574,045	688,320	239,399	53.3%	2.2%
ID	64,902	178,010	137,261	157,517	550,629	485,727	748.4%	1.7%
SC	1,262,532	1,128,909	1,049,804	1,116,366	545,990	−716,542	−56.8%	1.7%
Total	**28,898,115**	**27,820,390**	**27,307,564**	**27,882,636**	**25,505,382**	**−3,392,733**	**−11.7%**	**79.8%**

Exhibit 4.137. Indiana, Ohio, and Pennsylvania Trends for Lead and Lead Compounds, 2000−2004

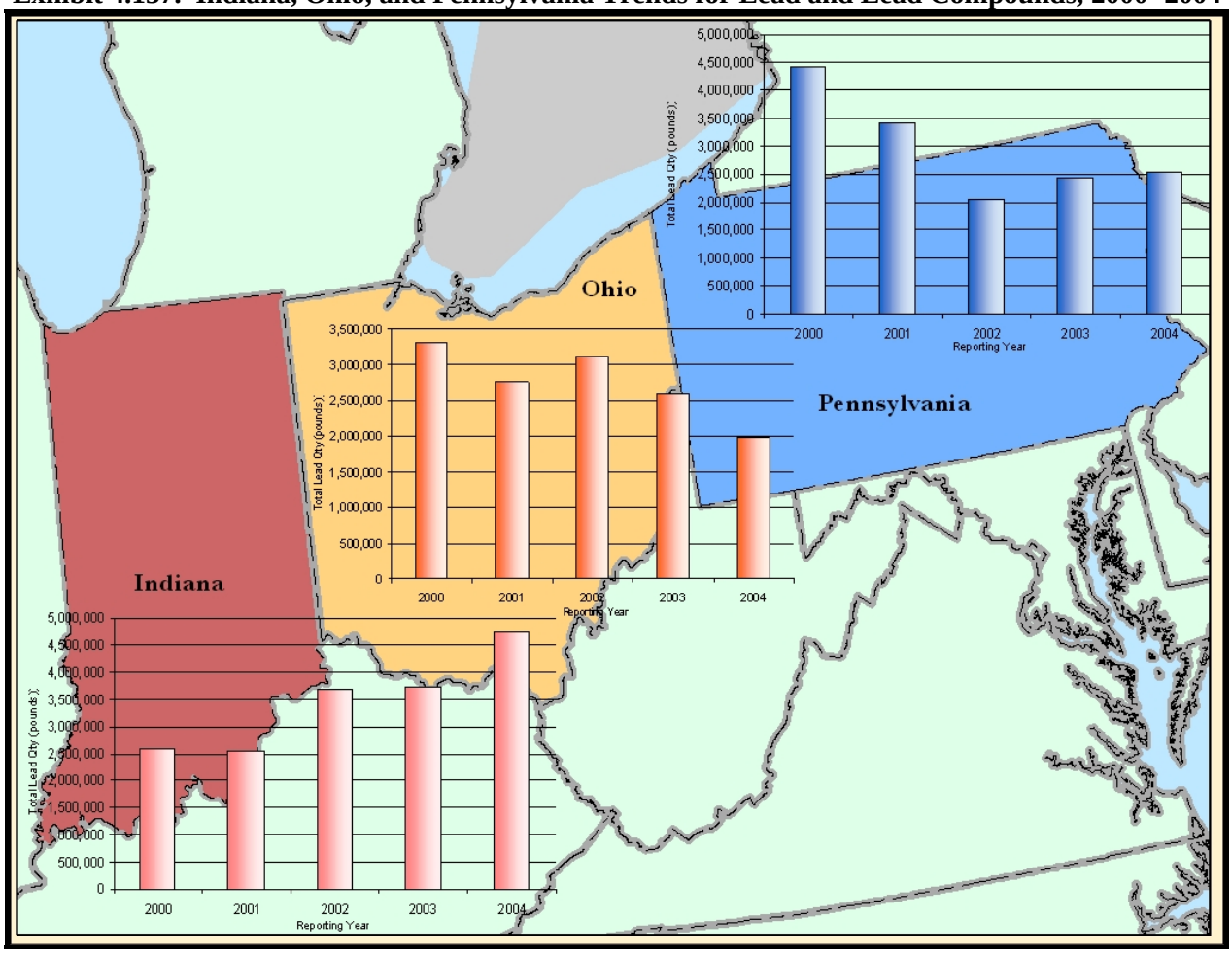


Exhibit 4.138. Alabama Trends for Lead and Lead Compounds, 2000−2004

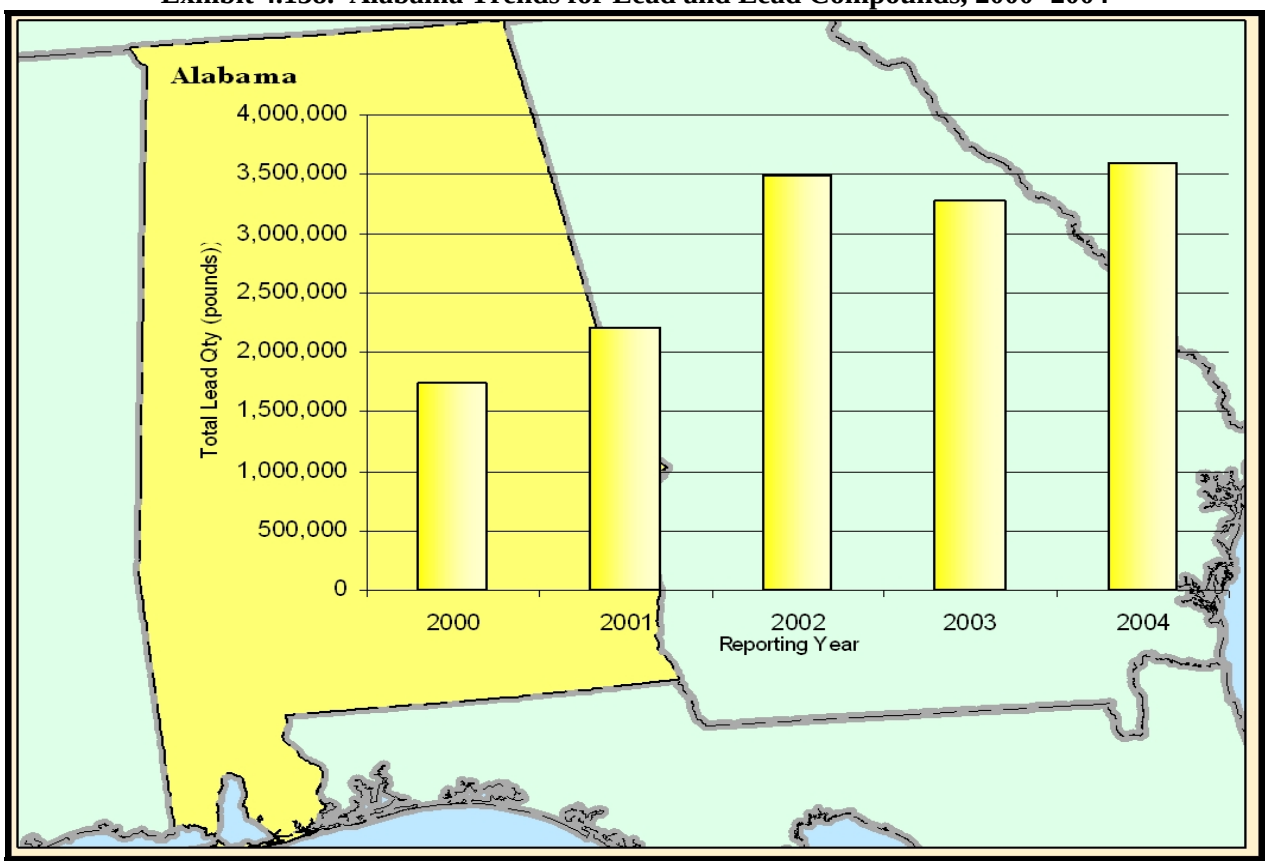
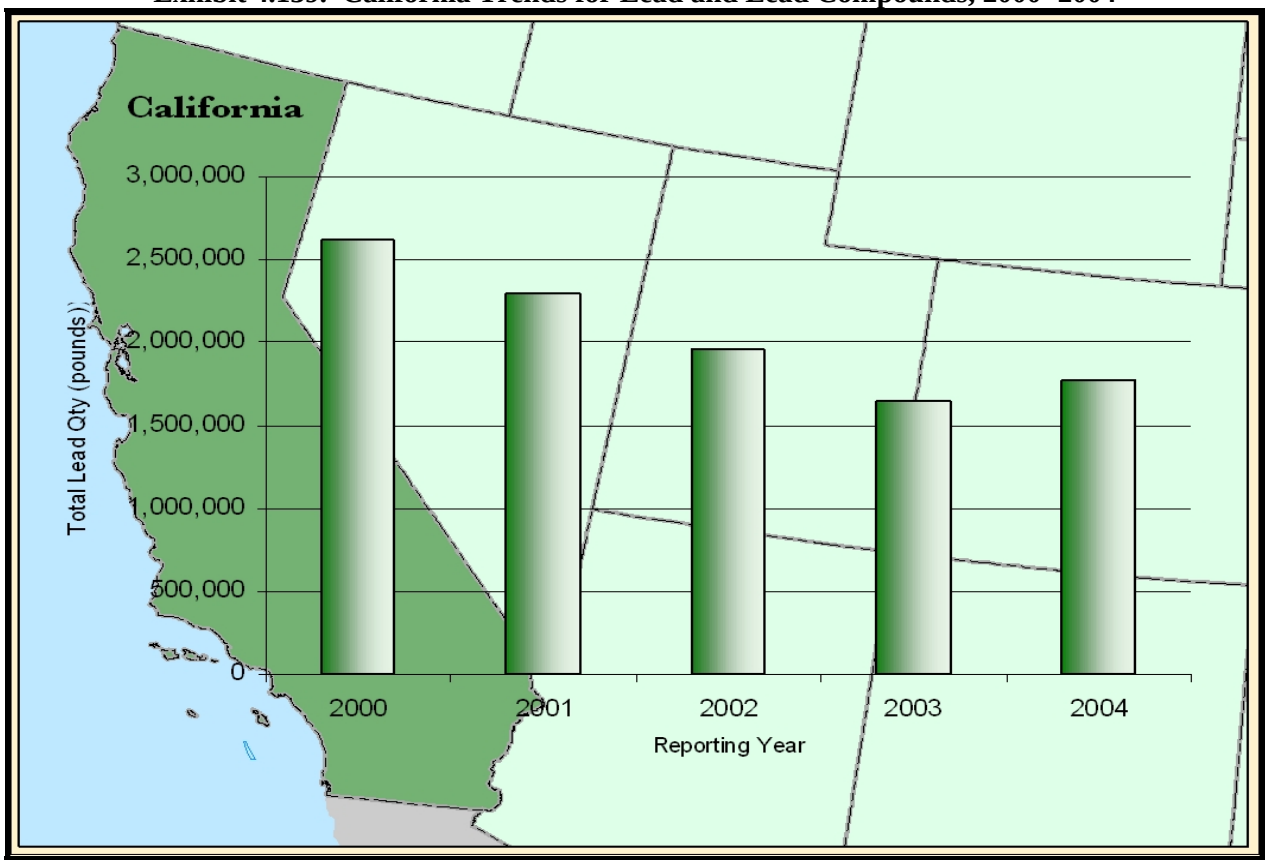


Exhibit 4.139. California Trends for Lead and Lead Compounds, 2000−2004

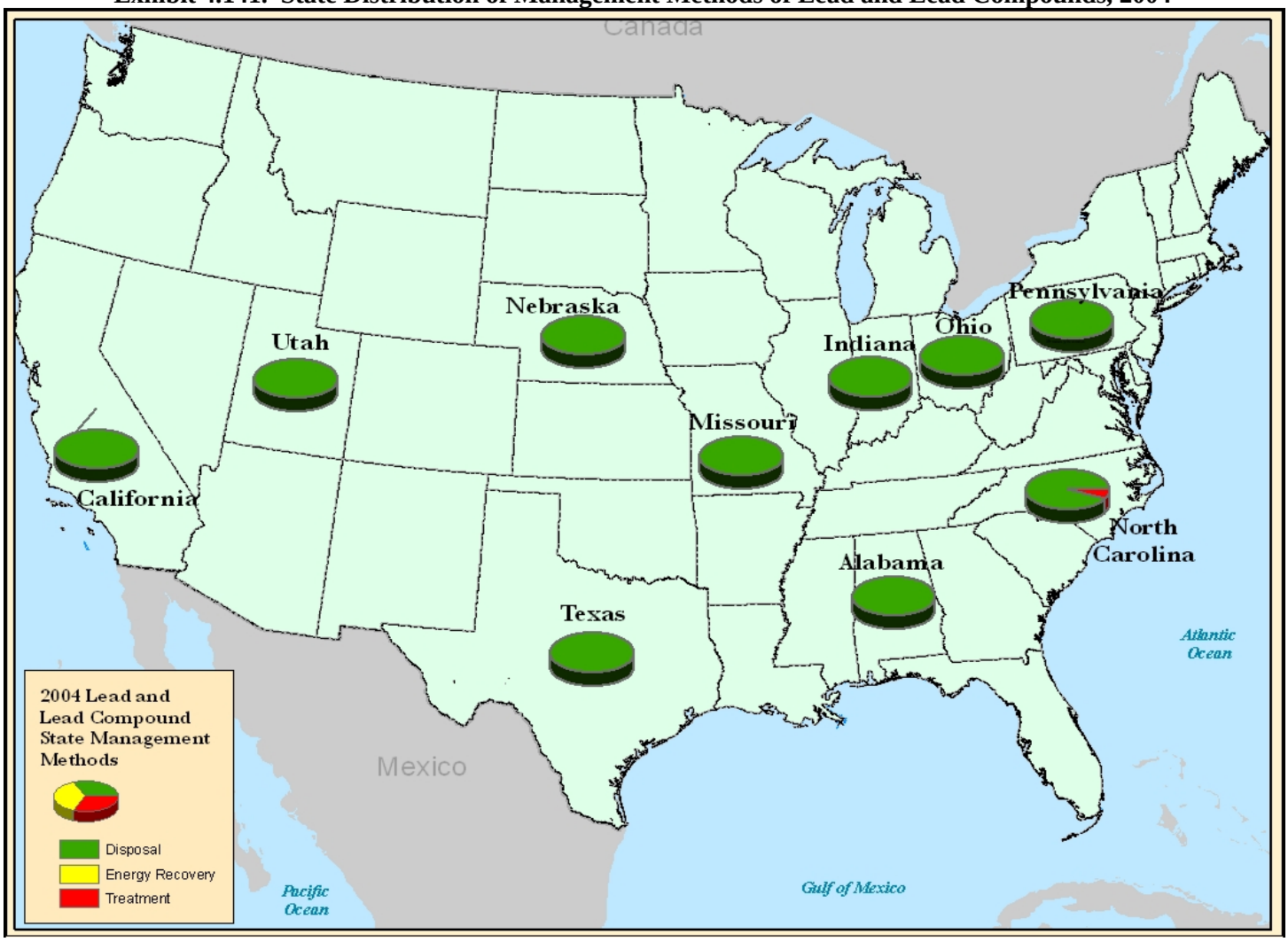


Exhibits 4.140 and 4.141 show how facilities managed lead in the 10 states for which facilities reported at least 1 million pounds of lead in 2004. Virtually 100 percent of the lead reported by facilities in these states was land disposed; facilities used offsite disposal for approximately 82 percent of the disposal quantity. Facilities in many of these states recycled significant quantities of lead, both onsite and offsite, in 2004.

Exhibit 4.140. State Management Methods for Lead and Lead Compounds, Facilities Reporting at Least 1 Million Pounds, 2004

State	Quantity of Lead (2004)	Onsite Disposal (pounds)	Offsite Disposal (pounds)	Onsite Energy Recovery (pounds)	Offsite Energy Recovery (pounds)	Onsite Treatment (pounds)	Offsite Treatment (pounds)	Onsite Recycling (pounds)	Offsite Recycling (pounds)
IN	4,734,448	128,077	4,604,224	0	0	0	2,148	37,953,078	6,307,312
AL	3,599,465	1,982,222	1,617,244	0	0	0	0	19,437,027	1,824,082
PA	2,531,839	6,715	2,525,124	0	0	0	0	19,789,965	6,901,119
OH	1,982,321	79,883	1,902,428	0	0	0	10	15,348,095	36,301,699
CA	1,776,292	135,253	1,640,454	0	0	503	81	15,080,059	10,511,236
MO	1,601,701	168,986	1,432,715	0	0	0	0	17,132,019	15,658,030
TX	1,381,123	677,990	703,098	0	0	0	34	478,527	2,695,904
NE	1,349,842	477	1,339,365	0	0	0	10,000	26	84,355
UT	1,088,558	91,221	997,298	0	0	0	39	13,275	85,741
NC	1,017,120	374,668	591,343	7	2	0	51,100	127,520	17,918,789
Total	**21,062,709**	**3,645,492**	**17,353,294**	**7**	**2**	**503**	**63,412**	**125,359,591**	**98,288,265**

Exhibit 4.141. State Distribution of Management Methods of Lead and Lead Compounds, 2004



Industry Sector (SIC) Trends:

Facilities in more than 300 industry sectors reported lead in 2004. Exhibit 4.142 shows the quantity of lead reported in the 17 industry sectors where facilities accounted for approximately 90 percent of this chemical in 2004. Facilities in SIC 3341 (Secondary nonferrous metals) and SIC 3312 (Blast furnaces and steel mills) reported approximately 60 percent of the total quantity of lead in 2004; facilities in each sector reported over 9 million pounds.

Some additional observations concerning increases and decreases include:

- Compared to quantities reported in 2000, facilities in 10 of these 17 industry sectors reported a larger quantity of lead in 2004.
- Compared to quantities reported in 2000, facilities in SIC 9711 (National security) reported an increase of approximately 2.2 million pounds. These facilities, primarily military installations, began reporting significant increases in 2001; most of the increased quantity is likely due to the increase in training and other activities at military installations in support of military operations to counter terrorism worldwide, including in Afghanistan and Iraq.

- Compared to quantities reported in 2000, facilities in two other industry sectors: SIC 3321 (Gray and ductile iron foundries) and SIC 8733 (Noncommercial research organizations) also reported large increases of 738,000 pounds and 500,000 pounds, respectively. A Department of Energy facility in Idaho accounted for most of the increase reported by SIC 8733 facilities.
- Compared to quantities reported in 2000, facilities in seven of the 17 industry sectors reported a decreased quantity of lead in 2004; the largest decreases of 3.5 million pounds and 727,000 pounds were reported by facilities in SIC 2819 (Industrial inorganic chemicals, nec) and SIC 3229 (Pressed and blown glass, nec), respectively.
- Compared to quantities reported in 2003, facilities in seven of the 16 industry sectors reported an increase; most notably, facilities in SIC 3312 (Blast furnaces and steel mills) reported an increase of 1.6 million pounds in 2004.
- Compared to quantities reported in 2003, facilities in nine of the 16 industry sectors reported a decrease; facilities in two industry sectors: SIC 3341 (Secondary nonferrous metals) and SIC 3321 (Gray and ductile iron foundries) reported decreases of 2.9 million pounds and 813,000 pounds, respectively. Most of the decreased quantity for SIC 3341 facilities was reported by a facility in Missouri which attributed the decrease to a lower production level in 2004 and process adjustments that resulted in a decrease in the concentration of lead in the slag.

Exhibit 4.143 shows how facilities managed lead in the five industry sectors for which facilities reported at least 1 million pounds of lead in 2004; facilities in these five industry sectors accounted for approximately 76 percent of the total quantity. Virtually 100 percent of the quantity reported by facilities in these industry sectors was land disposed, mostly offsite. Facilities in SIC 9711 (National security) primarily used onsite disposal. Facilities in each of these industry sectors recycled approximately 46 percent of the national total recycled quantity of lead in 2004; SIC 3341 facilities reported approximately 95 percent of the recycling reported by facilities in these five industry sectors.

Exhibit 4.142. Industry Sectors Containing Lead and Lead Compounds, Facilities Reporting 90 Percent of the Total Quantity, 2004

Primary SIC	SIC Description	Number of Facilities That Reported Lead (2004)	2000 (pounds)	2001 (pounds)	2002 (pounds)	2003 (pounds)	2004 (pounds)	Change in Quantity (2000−2004)	Percent of Total Quantity of This PC (2004)
3341	Secondary nonferrous metals	89	10,113,688	9,409,708	11,582,821	12,638,279	9,782,666	−331,022	30.6%
3312	Blast furnaces and steel mills	84	9,428,975	7,766,719	7,098,315	7,726,717	9,361,873	−67,102	29.3%
9711	National security	108	160,317	2,197,581	2,466,010	2,642,477	2,375,382	2,215,065	7.4%
3321	Gray and ductile iron foundries	137	959,498	2,625,256	2,942,616	2,510,574	1,697,804	738,306	5.3%
2819	Industrial inorganic chemicals, nec	73	4,553,382	1,810,764	1,411,839	1,217,083	1,057,561	−3,495,821	3.3%
3229	Pressed and blown glass, nec	34	1,715,864	1,538,505	1,282,440	1,161,252	988,756	−727,108	3.1%
3691	Storage batteries	58	722,480	269,737	332,210	502,985	803,083	80,602	2.5%
8733	Noncommercial research organizations	8	106	203,442	153,930	425,799	500,269	500,163	1.6%
3315	Steel wire and related products	36	955,200	795,912	421,572	502,771	496,974	−458,226	1.6%
3679	Electronic components, nec	114	578,214	236,204	156,985	276,457	350,832	−227,382	1.1%
3357	Nonferrous wire drawing and insulating	77	479,446	472,973	305,248	460,381	341,539	−137,907	1.1%
3482	Small arms ammunition	13	118,945	189,330	152,552	131,453	184,967	66,022	0.6%
2621	Paper mills	79	119,700	160,241	199,952	183,015	175,515	55,815	0.5%
3471	Plating and polishing	242	41,189	213,725	99,549	145,030	172,260	131,071	0.5%
2611	Pulp mills	55	12,400	147,759	135,024	176,770	160,819	148,419	0.5%
2874	Phosphatic fertilizers	11	0	241,921	144,699	141,793	150,333	150,333	0.5%
2631	Paperboard mills	73	0	124,600	110,849	125,784	130,406	130,406	0.4%
	Total	**1,291**	**29,959,404**	**28,404,377**	**28,996,611**	**30,968,618**	**28,731,041**	**−1,228,363**	**89.9%**

Exhibit 4.143. Management Methods for Lead and Lead Compounds in Industry Sectors (Facilities Reporting at Least 1 Million Pounds), 2004

Primary SIC	SIC Description	Total Quantity of Lead (2004)	Percent of Total Quantity (2004)	Onsite Disposal (pounds)	Offsite Disposal (pounds)	Onsite Energy Recovery (pounds)	Offsite Energy Recovery (pounds)	Onsite Treatment (pounds)	Offsite Treatment (pounds)	Onsite Recycling (pounds)	Offsite Recycling (pounds)
3341	Secondary nonferrous metals	9,782,666	30.6%	2,208,052	7,574,614	0	0	0	0	285,530,639	24,483,921
3312	Blast furnaces and steel mills	9,361,873	29.3%	167,698	9,194,176	0	0	0	0	312,584	13,993,144
9711	National security	2,375,382	7.4%	2,272,975	102,408	0	0	0	0	449,999	557,985
3321	Gray and ductile iron foundries	1,697,804	5.3%	397,304	1,300,500	0	0	0	0	99,808	353,586
2819	Industrial inorganic chemicals, nec	1,057,561	3.3%	181,428	876,092	0	0	40	0	52,969	338,594
	Total	**24,275,286**	**75.9%**	**5,227,456**	**19,047,790**	**0**	**0**	**40**	**0**	**286,445,999**	**39,727,230**